

REMARKS

Based on the manifest differences between the cited references and the claimed invention, the Applicant believes that the following remarks will convince the Examiner that the rejections in the June 16, 2006 Office Action should be reconsidered and withdrawn.

A. Claim Rejections Under 35 U.S.C. § 112, ¶ 2

Initially, the Examiner rejected claims 8, 17-18, 41-42, 45, 59, 66, 81-83, 93-94, 98, 106, 113, 120, 145-146, and 149-150 under 35 U.S.C. § 112, ¶ 2, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. According to the Examiner, the phrase “concentric configuration” in claims 8, 66, and 120 “is vague and indefinite because it fails to indicate what the part is concentric with respect to or relative to.” (Office Action, page 2). Applicant respectfully disagrees and submits that the concentric configuration is sufficiently disclosed. For example, the specification suggests the concentric configuration to be a “single-piece construction” that “eliminates any possibility of liquid metal leakage between the evaporator, hollow transport tube, and the liquid metal reservoir.” (Specification, Summary of Invention, page 24). That is, the “evaporator, hollow transport tube, and reservoir cylinder are machined concentrically from a single piece of refractory material.” (Specification, Summary of Invention, page 24). The pieces are concentric with respect to the refractory material so as to eliminate any possibility of liquid metal leakage. (See Figure 5 re claim 8, Figure 6 re claim 66, and

pages 24-26 of the specification.) Thus, Applicant submits that the claims are not indefinite and requests that the rejection be reconsidered and withdrawn.

Also, Claims 17-18, 45, 93-94, 98, 106, 145-146, and 149-150 were rejected as lacking proper antecedent basis, and claims 81-83 were rejected because, in the opinion of the Examiner, the phrase “said heater means” is vague and indefinite because it does not make clear which heater means it refers to. The Applicant has amended these claims accordingly, and requests that the rejection be withdrawn. Applicant thanks the Examiner for calling these to his attention.

B. Claim Rejections Under 35 U.S.C. § 103(a)

Next, the Examiner rejected all of the pending claims under 35 U.S.C. § 103(a) as being unpatentable over Sarraf U.S. Patent No. 5,558,720 (“Sarraf”), taken in view of Zega U.S. Patent No. 4,112,137 (“Zega”), De Lange U.S. Patent No. 2,508,500 (“De Lange”), Dale U.S. Patent No. 3,634,647 (“Dale”), Bennet U.S. Patent No. 2,568,578 (“Bennet”) and/or Mercer U.S. Patent No. 5,407,000 (“Mercer”).

Initially, in the opinion of the Examiner, claims 1-3, 8-20, 29-31, 40-53, 55, 66-82, 92-107, 109, 115-116, 118-135 and 144-152 (of which only claims 1, 49 and 101 are independent) are unpatentable over Sarraf in view of Zega, De Lange, Dale, Bennet and/or Mercer. (Office Action, page 3). Applicant respectfully disagrees.

For a claimed invention to be obvious in view of a combination of references, three criteria must be met: 1) there must exist a suggestion or motivation to modify the reference or to combine reference teachings; 2) there must be a reasonable expectation of success; and 3) the prior art references, when combined, must teach or suggest all of the

claim limitations. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991);

MANUAL OF PATENT EXAMINING PROCEDURE § 2143-2143.03. The Applicant respectfully submits that, even if proper, no combination of Sarraf, Zega, De Lange, Dale, Bennet and/or Mercer, teaches all of the limitations of the present invention as claimed in any of claims 1, 49 and 101.

Briefly, Sarraf, entitled "Rapid Response Vapor Source", describes a rapid response metal evaporator. In the opinion of the Examiner:

Sarraf discloses a liquid metal evaporation source for use in MBE process. Sarraf teaches (col. 1, lines 42-45) that MBE evaporators are limited by source depletion. Sarraf solves this problem by providing a heated supply tank of liquid metal melt along with a feed pipe for continuously replenishing the evaporator. Sarraf uses a capillary wick to pump (see col. 2, lines 30-32) the liquid metal out of the supply tank, and he doesn't discuss the use of a piston to push the liquid metal out of the supply tank. (Office Action, page 3).

Applicant disagrees. Rather, Applicant submits that Sarraf fails to teach a liquid metal evaporation source having a heater on the feed pipe, and the use of a piston to control the liquid, as the Examiner has agreed. Indeed, nowhere does Sarraf disclose three separate temperature zones (i.e., a high temperature evaporator, an intermediate temperature hollow transport tube, and a low temperature hollow reservoir cylinder) and a reservoir cylinder with a close-mating cylindrical piston. Sarraf also fails to teach the claimed invention's use of three separate heaters with three separate controls that sense and regulate the heater power for each heater.

While Sarraf does disclose an evaporator, Sarraf only uses a single filament for heating which leads to a temperature gradient across the evaporator surface. This temperature gradient results in different evaporation rates across the evaporator surface due to the heat-sinking properties of the capillary tube. Where a constant temperature is

not maintained, the evaporator flux will change with time. Further, the open surface porosity of the sintered tungsten layer on the evaporator determines the evaporation rate at a given temperature. This given temperature cannot be known *a priori*. Thus, another disadvantage of Sarraf is that no two evaporators will exhibit the same identical evaporation rates at a given temperature. In contradistinction, the present invention prevents any change in the evaporation flux with time because of its unique inventive characteristics (i.e., three temperature gradients controlled separately) which subsequently ensure that all evaporators exhibit identical evaporation rates at a given temperature.

In short, Sarraf does not disclose at least (1) the use of three different heaters to maintain three different temperatures (zones) in an evaporator, feed pipe and a reservoir, respectively, (2) the use of a feed pipe and a reservoir having a piston for moving the liquid metal from the reservoir to the evaporator, (3) the complex arrangement of sensors to control heaters in the three temperature zones, or (4) the use of conducting probes connected to an automatic feedback control circuit to control the piston, flow of liquid metal and the liquid level in the evaporator.

Next, the Examiner cited to Zega, De Lange and Dale, arguing that they “all disclose vaporizers of the type that are continuously supplied with liquid metal from a heated supply tank by pushing the liquid into the feed pipe.” (Office Action, page 3). According to the Examiner, “Zega teaches that this type of recharging system can be applied to feeding any source of evaporation of relatively low melting point.” (Office Action, page 3). The Examiner also opined that “Zega and De Lange teach that such a supply system should be provided with a separate heater on the feed pipe.” (Office

Action, page 3). The Examiner further stated that “De Lange (see element 11 of Fig. 2) and Dale (see col. 7, lines 14-19) teach that a piston in the supply tank can be used to push the liquid metal from the supply tank into the feed tube”. (Office Action, pages 3-4). The Examiner also stated that “[r]egarding the use of a conducting probe to sense the level of liquid in the evaporator, De Lange (see Fig. 1 and col. 4, lines 38-44) teaches this type of level sensor for sensing the level in an evaporator. De Lange also teaches (col. 4, lines 55-60) that this type of level sensor can be used to control the movement of a piston feeder of the type shown in De Lange’s Fig. 2”. (Office Action, page 4). The Applicant respectfully disagrees with the Examiner’s opinion that a combination of one or more of these references with Sarraf teaches or discloses the claimed invention.

First, Zega, entitled “Process for Coating Insulating Substrates by Reactive Ion Plating”, teaches electron beam evaporation of metals in a reactive oxygen atmosphere and discloses feeding the metal evaporation source by gravity or gas overpressure from an external liquid metal reservoir. Zega is very different from the present invention. That is, Zega does not teach or suggest at least three separate heaters for three separate temperature zones for the supply tank, feed pipe and evaporator, respectively, to control the three different temperatures zones (high, intermediate and low). Indeed, Zega specifically teaches away from this because it merely suggests the use of a heating jacket with thermal insulation about the supply tank and feed pipe as a means for controlling temperature. This is very different from the multiple heaters of the present invention. Moreover, Zega does not disclose or teach the use of a piston to control the liquid in the system as claimed in the present invention.

Referring next to De Lange, entitled “Apparatus for Applying Metal Coatings on Insulators”, described is an apparatus aimed at keeping the level of the liquid metal to be vaporized at a constant level. De Lange teaches the use of heating elements around the feed tube only, and teaches away from using a heating element on the evaporator. De Lange merely suggests use of a piston to displace liquid metal, but emphasizes as part of its invention the manipulation of atmospheric pressure to drive the metal from the filling vessel to the vaporization chamber by using a neutral gas. De Lange fails to teach a piston that is seal-proof and an apparatus having a control mechanism for the liquid level as in the present invention. Rather, De Lange uses the manipulation of neutral gas pressure exerted in the filling vessel to move the liquid.

Importantly, De Lange does not teach three different heaters with a thermocouple to sense and regulate the heater power, nor does it teach the use of three separate temperature zones (high, intermediate and low temperature zones). In fact, De Lange actually teaches away from heating the evaporator metal directly – it suggests using heat conduction of the liquid metal up the evaporation tube. This is very different from the present invention.

Finally, Dale, entitled “Evaporation of Multicomponent Alloys”, discloses a technique for evaporating a stoichiometric alloy by continually feeding a small evaporating area with a liquid metal through a feed pipe (thin wetted capillary tube) from a sealed reservoir containing the liquid metal which feeds it onto a heated evaporator. Briefly, Dale describes a single heating source for heating the reservoir, feed pipe and evaporator. Like De Lange, Dale, with its single heating source, teaches away from the claimed invention with its use of three separate heaters to control three distinct

temperature zones (i.e., low, intermediate or high temperature zones). Dale does not teach the use of a conducting probe connected with an automatic feedback control circuit by which to maintain a constant level of liquid metal in an evaporator as disclosed in the claimed invention.

Lastly, the Examiner cites to Bennet and Mercer as disclosing “a molten metal supply pipe [that] should be provided with its own heater and thermocouple based heater control means.” (Office Action, page 4).

Bennet, entitled “Electrically Heated Transfer Pipe”, discloses a method for transferring molten solids. In the Office Action, the Examiner noted that Bennet teaches a molten metal supply pipe with its own heater and thermocouple based heater control means. However, Bennet’s system does not and cannot control three temperature zones. It merely describes a single temperature zone. Moreover, the sole purpose of the single temperature zone is to prevent solidification of material in the feed tube. This is very different from the claimed invention.

Finally, Mercer, entitled “Method and Apparatus for Handling Molten Metals”, describes an automatic handling system for delivering molten metal to a casting machine. Mercer is similar to Bennet because its invention relates to a large capacity transfer pipe for molten metal. Mercer also discloses a molten metal supply pipe with its own heater and thermocouple based heater control means. Mercer does not, however, teach multiple and separate heaters to control different temperatures zones. Further, the apparatus of Mercer does not need or benefit from separate heaters to control different temperature zones.

As discussed above, no combination of Sarraf, Zega, Dale, De Lange, Bennet and/or Mercer disclose all the elements of the any of independent claims 1, 49 or 101. Thus, applicant respectfully requests the Examiner reconsider and withdraw this rejection. Because all of the remaining claims depend from one of these independent claims, Applicant submits that the rejection of those claims is similarly traversed.

As demonstrated from the above discussion, the present invention is a distinct improvement over the prior art. The present invention claims a liquid metal evaporation source having a means by which the metal evaporation conditions in the source remain constant and thereby ensure a constant rate of evaporation. This requires that the evaporation surface area, the distance to the substrate, and the evaporator metal surface temperature remain substantially constant over time. The three separate heated regions for three separate temperature gradients according to the claimed invention accomplish this. (See claims 1, 49 and 101). For the same reasons that the independent claims are not rendered obvious as set forth above, the dependent claims are not taught, disclosed or rendered obvious by the cited references, either alone or in combination.

Further, Applicant respectfully points out that, standing on their own, the cited references provide no justification for the combinations asserted by the Examiner.

“Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination. Under section 103, teachings of references can be combined only if there is some suggestion or incentive to do so.” *ACS Hospital Systems Inc. v. Montefiore Hospital*, 732 F.2d 1572, 1577, 221 U.S.P.Q. 929, 933 (Fed. Cir. 1984) (emphasis in original).

None of the cited references provide any suggestion or incentive for the combinations suggested by the Examiner. Indeed, as discussed below, they teach away from such

combinations. Therefore, the obviousness rejection could only be the result of a hindsight view with the benefit of the applicant's specification. However,

"To draw on hindsight knowledge of the patented invention, when the prior art does not contain or suggest that knowledge, is to use the invention as a template for its own reconstruction -- an illogical and inappropriate process by which to determine patentability. The invention must be viewed not after the blueprint has been drawn by the inventor, but as it would have been perceived in the state of the art that existed at the time the invention was made." (citations omitted). *Seasonics v. Aerosonic Corp.*, 38 U.S.P.Q. 2d. 1551, 1554 (1996).

In addition, the combination advanced by the Examiner is not legally proper -- on reconsideration the Examiner will undoubtedly recognize that such a position is merely hindsight. *See Orthopedic Equipment Co. v. United States*, 702 F.2d 1005, 1012, 217 USPQ 193, 199 (Fed. Cir. 1983):

"It is wrong to use the patent in suit as a guide through the maze of prior art references, combining the right references in the right way so as to achieve the result of the claim in suit. Monday morning quarterbacking is quite improper when resolving the question of nonobviousness in a court of law." *Id.*

Express motivation to combine any of the six (6) references is lacking.

The Examiner uses hindsight in the suggestion that "[i]t would have been obvious to use a separately heated feed tube and a piston to continuously supply an MBE evaporator of the type disclosed in Sarraf, because the secondary references teach that these expedients can successfully be used to continuously supply an evaporator as desired by Sarraf." (Office Action, page 4). However, nothing in these references suggests a combination of these references to produce the claimed invention. The only "motivation" for the Examiner's combination of Sarraf, Zega, De Lange, Dale, Bennet and Mercer can be found in the teachings of Applicant's own disclosure.

For example, Zega teaches away from the need of a separate heater for the supply

pipe, and instead, teaches the use of thermal insulating jacket around both the supply tank and the feed pipe as a means for controlling temperature, (see discussion *supra*, page 33), and Bennet and Mercer do not relate to the field of liquid metal evaporation.

C. Apparatus Claims May be Recited in the Claims by Structure or Function

Finally, the Examiner also stated that “claim 1 for example does not positively recite the conducting probe as part of the claimed apparatus, but instead refers to the conducting probe in terms of a process limitation (i.e. ‘wherein at least one conducting probe is used’) which is only a recitation of intended use that does not so limit the claimed apparatus combination”. (Office Action, pages 4-5). The Examiner added that “[t]he same is true for the description of intended use that follows the phrase “can be used” in line 11 of claim 1. The elements referred to there are not part of the claimed apparatus.” (Office Action, page 5). The Examiner further stated “any particular temperature or relative temperature recited in the present apparatus claims represents a recitation of intended use of the claimed apparatus and does not so limit the apparatus claims.” (Office Action, page 5). However, the Examiner failed to provide a basis for this rejection.


In response, applicant submits that apparatus claims may be recited either structurally or functionally. *See In re Schreiber*, 128 F.3d 1473, 1477-78, 44 USPQ2d 1429, 1431-32 (Fed. Cir. 1997); MPEP § 2114. The conducting probes, the temperature controls, and the three temperature gradients, are all structural elements of the claimed apparatus, which are further defined by their function. Accordingly, Applicant respectfully requests that this rejection be reconsidered and withdraw.

CONCLUSION

In view of the foregoing, the Applicant submits that the present invention, for the first time, discloses a means and method for a liquid metal evaporation source with an integral level sensor and external reservoir, which employs a three-temperature gradient to ensure a constant rate of evaporation. The specification, drawings and pending claims represent a patentable contribution to the art and are in condition for allowance. Early and favorable action is accordingly solicited.

Respectfully submitted,

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